Contribution ID: **43** Type: **not specified**

Realistic scattering of puffy dark matter

If dark matter has a finite size, the intrinsic interaction responsible for the structure formation is inevitable from the perspective of dark matter self-scattering. To describe the circumstance in which the binding force realizes the finite size dark protons, we first use the eikonal approximation to simplify the convoluted scattering between dark protons into the case at the t ¼ 0 limit. The Chou-Yang model is then introduced to reduce the number of input parameters to one based on the simplicity and analyticity principle. A new definition of velocity dependence and the corresponding implications on the small cosmological structures from Chou-Yang dark protons are shown clearly. Even though the parameter space is not fully covered, the numerical findings show that the amplitude coefficient can alter the self-scattering cross section, allowing us to recover the excluded parameter space without using binding force. Finally, we demonstrate that the correct relic density from thermal freeze-out production prefers super heavy dark protons.

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Session Classification: 分会报告（理论）